SECTION 13220

STORAGE TANKS

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LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Mechanical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Information within "stars" is provided as guidance to the author responsible for revising the specification. Delete information within "stars" during editing.

This specification serves as a template. The specification was prepared by an organization operating under a quality assurance program that meets the requirements of 10 CFR 830 (suitable for ML-1 through ML-4 projects). Implementation of this specification requires modification to the specification to meet project-specific requirements. Responsibility for application of this specification to meet project-specific requirements lies with the organization modifying or implementing the specification. The organization modifying the specification shall apply a graded approach to quality assurance based on the management level designation of the project. When this specification is used with nuclear facilities subject to 10 CFR 830, modification to this specification must be performed by an individual or organization operating under a quality assurance program that meets the requirements of that CFR.

This specification is a general specification covering LANL storage tank applications for low pressure vessels storing fluids for lab or Hi-Tech manufacturing operations. It does not apply to fire protection systems covered under NFPA Bulletin 22 and AWWA D 100 series standards.

This specification is intended to be used for design/build procurements of storage tanks. For the purposes of this specification, a storage tank is defined as a container designed for not more than 15 psig internal pressure capability.

This specification is applicable both to new acquisitions and to modifications or repair work to existing storage tanks.

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PART 1 GENERAL

1.1 SCOPE

A. This specification establishes the technical requirements for the design, materials of construction, fabrication, testing, shipment, and quality assurance (QA) of storage tanks, their supports, components, and appurtenances.

B. The technical requirements of this specification are applicable to containers used primarily for atmospheric or non-pressurized storage of fluids, or storage of fluids at very low gauge pressure. The upper limit of internal pressure for tanks built under this specification is 15 psig (34.6 ft water column).

NOTE: "Internal Pressure" refers to a uniformly distributed internal pressure in tank, and is in addition to the normal varying pressure head due to depth of contained fluid.

C. API Standard 650, Welded Steel Tanks for Oil Storage, covers the basic design of steel storage tanks operating at approximately atmospheric pressure (internal pressure up to an equivalent of lid weight is allowed). By following the additional requirements of Appendix F, the internal pressure limitation may be raised to 2-1/2 psig.

D. If internal pressures greater than 2-1/2 psig are required, the additional requirements of API Standard 620, Design and Construction of Large, Welded, Low-Pressure Storage Tanks shall be applied. This Standard covers steel storage tanks up to a maximum internal pressure design limit of 15 psig.

E. These tanks are not intended to support external pressure (internal vacuum). For closed tanks, incorporate a relieving device to prevent the formation of a vacuum inside the tank.

F. For tanks containing toxic fluids, where the potential for personnel exposure is significant and a single exposure to a small leakage can cause serious harm, the requirements of ASME B31.3, Process Piping, Category M Fluid Service, also apply though tanks are outside the Code's scope.

G. The following is a summary of supplier responsibilities described in this specification:

1. Design/fabricate storage tanks in accordance with:
    a. This specification,
    b. API-650,
    c. API-620,
    d. Supplier's LANL-approved drawings,
    e. ASME B31.3 Process Piping,
    f. Category M (when applicable), and
    g. Other referenced documents.
2. Furnish design data required by this specification to document design of the storage tank.
3. Procure equipment, materials, or supplies to complete the work, unless otherwise stated.
4. Test and inspect as required by this specification, API-650, API-620 (where applicable), and ASME B31.3, Category M (where applicable).
5. Furnish the data required by this specification to document that required tests and inspections have been performed.
6. Package, ship, and deliver the storage tank.
7. Provide LANL full access to the facility for performing random or scheduled inspections and/or surveillance of work performed.

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Edit LANL Sections listed below for applicability to meet the project requirements associated with the storage tank to be designed and fabricated. Add other Sections if needed.

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1.2 RELATED SECTIONS

A. Section 01330, Submittal Procedures

B. Section 01630, Product Options and Substitutions

C. Section 05120, Structural Steel

D. Section 05063, Stainless Steel

E. Section 13085, Seismic Protection

1.3 REFERENCES

Codes, specifications, and standards referred to by number or title form a part of this specification to the extent required by the following references. Use codes, specifications, and standards referenced below of the latest revision at the time of award of contract, unless otherwise stated below.

A. 10 CFR 830.122: Nuclear Safety Management, Quality Assurance Criteria

B. API Standard 650: Welded Steel Tanks for Oil Storage (API-650)

C. API Standard 620: Design and Construction of Large, Welded, Low-Pressure Storage Tanks (API-620)

D. ASME B31.3: Code for Pressure Piping: Process Piping, Category M

E. ASME B16.5: Pipe Flanges and Flanged Fittings

F. ASME B16.47: Large Diameter Steel Flanges: NPS 26 Through NPS 60

G. ASME Boiler & Pressure Vessel Code (BPVC), Section IX: Welding & Brazing Qualifications

H. DOE-STD-1020: Natural Phenomena Hazards, Design and Evaluation Criteria for Department of Energy Facilities

I. DOE-STD-1021, Natural Phenomena Hazards, Performance Categorization Guidelines for Structures, Systems, and Components

J. LANL Engineering Manual

K. National Fire Protection Association Codes (as they apply to storage of flammable liquids)

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The author editing this specification is required to define many aspects of the storage tank design, including management level designation of the storage tank in accordance with LIR 230-01-02, Management Level Determination. Following the designation of management level, interpret the requirements for the designated management level and define those requirements in this specification.

Perform the following analyses or define requirements for the following within the specification:

- Establish the service conditions and design requirements for the storage tank, also considering factors associated with startup, normal operation, and shutdown. Determine operating pressures and temperatures, and design pressures and temperatures. Determine maximum design liquid level in tank, and the specific gravity of the liquid to be stored.
- For uniform internal pressures (in addition to liquid head), the following apply:

  Internal Atmospheric pressure (0 psig): Requirements of API-650

  Internal Pressure to 2-1/2 psig: Add the requirements of Appendix F (API-650)

  Internal Pressure to 15 psig: Add the requirements of API-620
- Determine the materials of construction of the storage tank, as required by the service conditions.

- Consider corrosion allowances.
- For tanks containing toxic fluids, where the potential for personnel exposure is significant and a single exposure to a small leakage can cause serious harm, also apply the requirements of ASME B31.3, Category M.
- Thermal stress relief is a recognized method for reducing the probability of brittle failures in the case of true pressure vessels. The majority of storage tanks covered by this specification will not be subjected to conventional postweld heat treatment/thermal stress relief after fabrication. However, for more critical applications, consider thermal stress relief. For API-620 tanks, depending on service conditions--and thus the required tensile strength of the storage tank containment boundary material--determine if preweld or postweld heat treatment is required. If so, specify the heat treatment(s) needed.
- Attach a data sheet and sketch as "Attachment 1" to summarize design requirements and storage tank configuration/nozzles. Blank storage tank data sheet forms are provided in Appendix L of API-650.
- Determine whether the storage tank will require any coatings, linings, or insulation. If so, specify or allow Supplier to recommend a system for LANL approval.
- Flat-bottom API tanks usually require full support across the tank bottom. Before beginning storage tank procurement, review the designated installation site for any building, facility floor, concrete slab, or soil loading limitations. Determine what foundation structures may be needed to support the tank. Determine if there are any clearance problems in moving the storage tank to its installation site.

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1.4 SYSTEM DESCRIPTION

A. General Design Requirements

1. For storage tank operating conditions, design data, and vessel configuration, refer to Attachment 1, Storage Tank Data Sheet.

2. Design, fabricate, test, and label storage tanks in accordance with:

   a. This specification,

   b. API-650,

   c. API-620 (when applicable),

   d. Supplier's LANL-approved drawings,

   e. ASME B31.3, Category "M" (when applicable), and

   f. Applicable regulations.

3. If there is a conflict among the above listed requirements, compliance with API-650, API-620, ASME B31.3, Category M, and applicable regulations will take precedence. Bring any conflicts to LANL's attention for resolution.

4. LANL will review and comment on design calculations and drawings. The LANL review does not release the supplier from responsibility to design and fabricate the storage tank in accordance with API-650, API-620, ASME B31.3, Category M, applicable regulations, and this specification.

5. A tank made in accordance with API-650, or in accordance with the additional requirements of API-620, will be identified by a nameplate as specified in the appropriate standard.

B. Containment Boundary Design Requirements

1. Proposed weld joint configurations are to be approved by LANL prior to fabrication, unless LANL chooses to waive this requirement.

2. Identify joints that are to be welded from one side only.

C. Nozzle & Manway Requirements

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The specification author will identify/define the piping systems that will interface with the storage tank and specify the necessary nozzles and connections required on the tank. Specify any maintenance access openings (manways) or other large openings needed on the storage tank. Include small penetrations, such as pressure and temperature monitoring ports. Check whether level monitoring instrumentation is required. Also specify plugged spare penetrations for possible future use, if desirable. Provide a data sheet (refer to API-650, Appendix L for data sheet forms) with a conceptual sketch or drawing to clarify requirements. Attach at end of this specification as "Attachment 1."

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1. Provide sufficient projection of flanged nozzles to allow removal of flange bolts from either side without removal of insulation (if used).

2. Make nozzles that are used as drains flush with tank interior surface.

3. Refer to Paragraph 2.4 for Non Destructive Examination (NDE) requirements.

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Determine and specify storage tank lifting requirements, including any LANL-specific hoisting and rigging requirements for the storage tank design.

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D. Structural/Supports

1. Design and construct storage tank foundations in accordance with Appendix B of API-650 supplemented by Appendix C & D of API-620, as applicable. API-650 tanks will generally need the bottom plate fully supported.

2. Where required, determine the overturning stability of the tank due to wind loading (API-650, Paragraph 3.11).

3. Design storage tank and foundation to meet DOE Performance Category (PC) [PC-X] requirements for seismic events. Refer to API-650, Appendix E, and API-620, Appendix L.

4. Incorporate lifting features into the storage tank design as required. Design and position lifting features to prevent any strain or distortion of the storage tank. Design lifting features to accept lifting by forklift, crane, or other appropriate device, and label these features appropriately as lifting points.

5. If lifting lugs are not provided as a feature of the design, indicate suitable lifting points on the main storage tank framework. If necessary, provide external strong-backs or other bracing devices.

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Specification author will determine and specify the type, thickness and configuration of storage tank linings, coatings, or insulation where needed or request Supplier's recommendation for LANL approval.

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E. Storage Tank Linings, Coatings, and Insulation

1. Storage tank Supplier shall evaluate the design conditions supplied by LANL and determine whether tank linings, coatings, and/or insulation may be required. If so, Supplier shall recommend the preferred system to LANL for concurrence and approval.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01330, Submittal Procedures.

B. Provide reference to LANL Project ID Number, LANL Contract Number, Storage Tank Number, Storage Tank Title, and Drawing Number on correspondence.

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Note to Specification Author: Add or delete project specific requirements as required.

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1. Drawings, Calculations and Supporting Data

a. Submit design drawings, calculations, and supporting data prior to beginning storage tank fabrication. LANL will review and comment on design calculations and drawings. The LANL review does not release the supplier from responsibility to design and fabricate the storage tank in accordance with API-650, API-620 (if applicable), ASME B31.1, Category M (if applicable), applicable regulations, and this specification. Include assumptions and input/output data with the calculations. If computer calculations are performed, include the name of the calculation program and the version number.

2. Quality Assurance/Quality Control

a. Submit an uncontrolled copy of the Supplier's QA manual for LANL approval. LANL may waive this requirement if the Supplier's QA program has been previously reviewed and approved.

b. Notifications: Notify LANL at least 7 days in advance for Acceptance Testing and Final Inspection.

c. Submit a Lower Tier Services Plan if outside subcontractors will perform some of the work. Provide LANL with the name, address, telephone number, and point of contact for outside services that the supplier intends to use on this project. Identify the specific work requirements of this specification that will be performed by those outside services.

d. Submit a Fabrication Schedule.

e. Material Control Procedure: Prior to fabrication, submit for LANL approval a material control procedure to be used in the execution of the work. Describe the control methods and traceability documentation in the procedure used by the supplier to handle and monitor the use of controlled materials, such as stainless steel and welding filler rod. Address in the procedure items such as procurement controls, segregation of materials, and traceability of materials from receipt at the shop through processing and final assembly.

f. Fabrication Procedures: Submit a copy of:

i. Welding Procedure Specifications (WPS)
ii. Welding Procedure Qualification Record (PQR)
iii. Welding & NDE Personnel Listing
iv. Liquid Penetrant Test Procedure
v. Radiographic Test Procedure
vi. Leak Test Procedure

g. Certifications: Submit a copy of:

i. Welder Performance Qualification Records
ii. NDE Personnel Certifications
iii. Material certifications for steel, weld filler materials, and certify the chloride content of materials used in fabrication of stainless steel.

h. Test Reports: Submit a copy of:

i. Liquid Penetrant Test Report
ii. Radiographic Test Report
iii. Leak Test Report

i. Shipping Submittals: Submit a copy of:

i. Supplier's vessel Cleaning Procedure
ii. Supplier's Packaging Procedure
iii. Bill of Lading with the storage tank shipment.

3. Nonconformances

a. Submit a written request to LANL for any proposed technical changes, exceptions, and/or deviations to this specification or other contract documents. Do not implement proposed changes, exceptions, or deviations until the LANL Contract Administrator provides written approval.

b. Conflicts: Notify LANL as soon as possible in the event of conflicts among the specifications, drawings, and/or the manufacturer's recommended processes or instructions.

4. Warranty: Supplier is to guarantee the storage tank and associated equipment at design conditions and warrant that materials and workmanship, plus apparatus supplied (if any), are in accordance with contract document requirements.

1.6 QUALITY ASSURANCE

A. The Supplier's QA program shall control a combination of design, materials, preparation, fabrication, inspection, testing, cleaning, packaging, and shipping that have to be done correctly to ensure the production of an acceptable finished product.

B. API-certified storage tanks shall be furnished by a firm qualified, accredited, and regularly engaged in this type of work. Supplier shall maintain shop and facilities suitable for fabrication of certified storage tanks. Supplier shall maintain a Quality Control Program that complies with ASME B&PV Code, Section VIII, Appendix 10.

1.7 DELIVERY, STORAGE, & HANDLING

A. Shipping Preparation: Mode and method of transporting, and the extent of storage tank assembly are to be mutually agreed on by the Supplier and LANL prior to fabrication and delivery of the tank. The packaging procedure submitted for prior approval by LANL shall be used. For safety considerations, a means of pressure relief is to be provided on the storage tank during shipping to prevent pressure buildup and/or to equalize pressure due to elevation and/or temperature changes.

B. Shipping & Receiving: Provide LANL with a copy of the bill of lading concurrent with the shipment. Properly and clearly describe the shipment on the bills of lading. At final destination, LANL will inspect the shipment as necessary to ensure that received items have not been damaged during shipment and that required items and supporting documentation have been received. The receipt inspection by LANL at Los Alamos constitutes final acceptance.

1.8 SITE CONDITIONS

A. Design storage tanks and associated components for a design altitude of 7,500 feet above sea level. Design storage tanks and associated components for a design ambient temperature appropriate to the installation location.

PART 2 PRODUCTS

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An approved vendors list will be established for storage tank vendors in accordance with the appropriate Quality Assurance Program Plan. Specification authors are to select vendors from the approved vendors list. For a listing of currently approved vendors, contact NMT Division.

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2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with Section 01630, Product Options and Substitutions.

2.2 MANUFACTURERS

A. [List companies from an approved vendors list that specialize in designing and manufacturing the products specified in this Section with suitable documented experience of performing similar work.**********]

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Determine and specify the type of material to be used for the storage tank shell, nozzles, connections, hatches, supports and other appurtenances. Specify material based upon application and compatibility with the process and corrosive environments. Some structural shapes may be difficult to obtain in certain materials, without special order (allow for longer lead times).

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2.3 MATERIALS

A. Provide materials complying with API-650 and API-620, as applicable.

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Determine and specify the type, thickness and configuration of storage tank linings, coatings, and/or insulation where needed, or request Supplier's recommendation for LANL approval.

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B. Protective Linings, Coatings, and Insulation

1. Vessel Supplier shall evaluate the design conditions supplied by LANL and determine whether vessel linings, coatings, and/or insulation may be required. If so, Supplier shall recommend the preferred materials to LANL for concurrence and approval.

2.4 FABRICATION

A. Protect stainless steel against carbon steel contamination from tooling and fixtures during fabrication.

B. Exercise control during stages of fabrication to minimize exposure of stainless steel to contaminants, in particular to any chloride that might cause stress-corrosion cracking. Avoid chloride-bearing compounds; however, if used, completely remove by thorough cleaning. Do not use compounds, liquids, or markers on stainless steel surfaces that contain more than 250 ppm of chloride content by weight.

C. Welding: Ensure that welders, welding operators, and tackers are qualified in accordance with ASME B&PVC, Section IX, Welding & Brazing Qualifications. Use welding procedures per ASME B&PVC, Section IX, Welding & Brazing Qualifications.

D. Surface Finishes: Exercise care to prevent scratching, abrading, nicking, and denting during receiving, storage, fabrication, and handling.

E. Cleaning:

1. After fabrication is completed, and before testing and inspection, clean, de-scale, and degrease the storage tank and associated components. Clean exterior surfaces, but take particular care to clean the inside of the tank thoroughly. Methods may include cleaning by hot water spray, etc. If a detergent is required, use a detergent that has less than 250 ppm chloride content for stainless steel tanks.

2. Use fresh water with less than 250 ppm chloride content for wash and final rinse. After final rinse, dry inside surfaces using heat, lint-free cloth or other means to ensure cleanliness. If de-ionized water is used for the final rinse, the tank may be allowed to evaporate to dryness. If heat is used for drying stainless steel vessels, do not allow the metal temperature to rise above 250 °F and use de-ionized water for the final rinse before drying.

3. Ensure that the cleanliness of the storage tank meets the approval of LANL at the time of the final inspection.

2.5 SOURCE QUALITY CONTROL

A. Shop Acceptance Tests: Perform inspection and testing of the completed storage tanks in accordance with the requirements of API-650 and API-620, and ASME B31.3 Category M, as applicable. The term "Inspector", as used in the API Standards, refers to the LANL inspector. Provide the test location, equipment, instrumentation of certified accuracy, and any supplementary temporary connections and auxiliary parts necessary to fully execute the tests. Provide test personnel qualified to conduct, record, and verify test results. Provide LANL with a minimum seven (7) working day advance written notice of shop acceptance tests. Submit the test results as part of the QA Document Package in accordance with LANL Section 01330.

B. Weld Inspection

1. Minimum radiography: Refer to API-650 and API-620, as applicable, for details of requirements.

2. Magnetic particle and liquid penetrant examination: If specified, perform magnetic particle examination in accordance with requirements in API-650 and API-620, as applicable. Liquid penetrant inspection may be substituted for non-magnetic material or if approval is obtained from LANL. Perform liquid penetrant testing after any grinding and polishing operations. Repair and re-test detected defects.

C. Pressure Test:

1. Test tanks designed for a maximum of 15 psig internal pressure to the requirements of API-620.

2. Test API-650 tanks designed for small internal pressures (2-1/2 psig max) per API-650, Appendix F, Paragraph F.4

3. Test API-650 tanks designed for atmospheric pressure operation by filling with water to hydrostatic test level without tank pressurization, per API-650.

4. Vent tank to atmosphere while filling or draining tank. Weld surfaces are to be free of coating materials during test. Water for shop-testing austenitic stainless steel tanks is to be potable quality with a chloride ion content of less than 50 ppm. After testing, drain water from tank. Wipe standing water dry—do not allow it to evaporate to dryness, unless de-ionized water is used.

D. Test Reports: Provide test reports as required by API-650, API-620, the contract documents, and this specification. Include the following information in the test report:

1. Storage tank identification

2. Date of test

3. Name and signature of the certified test operator

4. Location and description of indications

5. Description of repairs and retest

6. Signature of witness.

E. Nameplates & Labeling:

1. Attach a Manufacturer's Certification Nameplate to the storage tank in accordance with the requirements of API-650, Section 8, Marking, or API-620, Section 6, Marking, as applicable.

2. Attach a nameplate to each pressure storage tank for LANL identification. This information may be incorporated into a single nameplate with the API requirements, if desired. Clearly separate the API information from the LANL information.

3. Nameplate may be attached to the tank by welding, brazing, or soldering and in such a manner so as not to weaken storage tank strength or alter tank material properties. Nameplate cannot be removed without destruction of the nameplate.

4. Nameplate is to be austenitic stainless steel and the attachment bracket shall have sufficient projection to clear storage tank insulation, when present.

PART 3 EXECUTION

Installation of storage tanks is facility-specific and not covered in this Section. The Specification Author is to address installation for his specific location and application. Install storage tanks in accordance with the requirements of API-650 and API-620, as applicable.

END OF SECTION

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Do not delete the following reference information:

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FOR LANL USE ONLY

This project specification is based on LANL Master Construction Specification Rev. 0, dated December 5, 2002.

Section 13220 -- Attachment 1

Storage Tank Data Sheet and Sketch

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Specification author is to photocopy the Storage Tank Data Sheet provided in Appendix L of API-650, fill in the required information and annotate the sketch, then attach the completed Data Sheet behind this page.

The author may also create a custom data sheet and sketch, if more appropriate for a specialized tank.

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